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TACTICAL AIRCRAFT MAINTENANCE LEVEL SUCCESS

WITH THE EXPEDITIONARY COMBAT SUPPORT SYSTEM

By

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Biography

Lieutenant Colonel David M. Haar is currently a student at the Air War College, Maxwell Air Force Base, Alabama. Prior to attending Air War College he served as the Deputy Commander for the 19th Maintenance Group, Little Rock Air Force Base, Arkansas. The group had 3 squadrons, over 1,600 personnel and 48 C-130 aircraft performing worldwide airlift missions. The group executed an annual flying-hour program of 22,650 hours and an operating budget of more than $100 million.

Colonel Haar entered the Air Force in 1989 through the University of Notre Dame ROTC program, where he was a distinguished graduate. He has held positions at the wing, center and major command. As an aircraft maintenance officer, he has experience with the B-1B, KC-135, RJ-135U/V, and C-130E/H/J working in both the flight line, back shop and quality assurance environment. While at Wright-Patterson he served as an acquisition logistics engineer. Colonel Haar has deployed multiple times in support of Operation DESERT STORM, ENDURING FREEDOM, and IRAQI FREEDOM. Colonel Haar holds a bachelor's degree in Aerospace Engineering from the University of Notre Dame, and a Masters in Science from the University of Dayton.

INTRODUCTION

A commonly used quote from the Greek philosopher Heraclitus of Ephesus, "the only constant is change and change is the only constant" can be easily observed in the organizational history of the aircraft maintenance community. In 1958, Major General T. Alan Bennett, the Director of USAF Maintenance Engineering, commented upon the need to focus on the aircraft maintenance field and the drive for change:

> The Maintenance-Engineering functional area currently uses or controls approximately 33% of the total manpower and 40% of the available operating dollars allocated to the USAF [to date]…indications are that Maintenance-Engineering will play an even more dominant role in future operations with no increase in resources.[1]

The tactical aircraft maintenance level has undergone a myriad of organizational change since the birth of the U.S. Air Force in 1947. The aircraft maintenance community has centralized and decentralized with the demands placed upon it and the resources available. Through the multitude of centralizations and decentralizations both organizational successes and failures have been discussed at length, as the next series of changes is proposed and implemented. The amount of change endured by the maintenance community has been so high that recent discussions have focused around selecting one organizational type and stopping the organizational turmoil. In today's environment of declining resources (limit of military personnel available and a continually declining military budget) the Air Force is preparing to implement its most significant changed called the Expeditionary Combat Support System (ECSS), centralizing hundreds of databases and management into a singular system in an effort to reduce operational costs and redundancy.

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[1] Capt George D. Benjamin, *An Analysis of Aircraft Maintenance Management within Air Weather Service,* (Air University, Air Command and Staff College, Research Report, June 1965), 12.

This paper looks at the ECSS change, and identifies the most significant risks at the tactical aircraft maintenance level of the most dramatic change in the history of the Air Force. This paper will examine and analyze the historical cyclical centralizations and decentralizations caused by available resources. This paper will argue the success of the ECSS change at the tactical aircraft maintenance level will decided by a leadership that understands and supports this change, and provides effective training for maintenance personnel. This paper will show the historical negative effects of the centralizations and decentralizations on the tactical aircraft maintenance level.

HISTORY, BUDGET, AND PERSONNEL STRENGTH

Historically speaking, when looking at the annual defense spending and personnel strength, there is a distinct correlation between periods of conflict and the mobilization/de-mobilization and spending as a percent of gross national product (GNP).
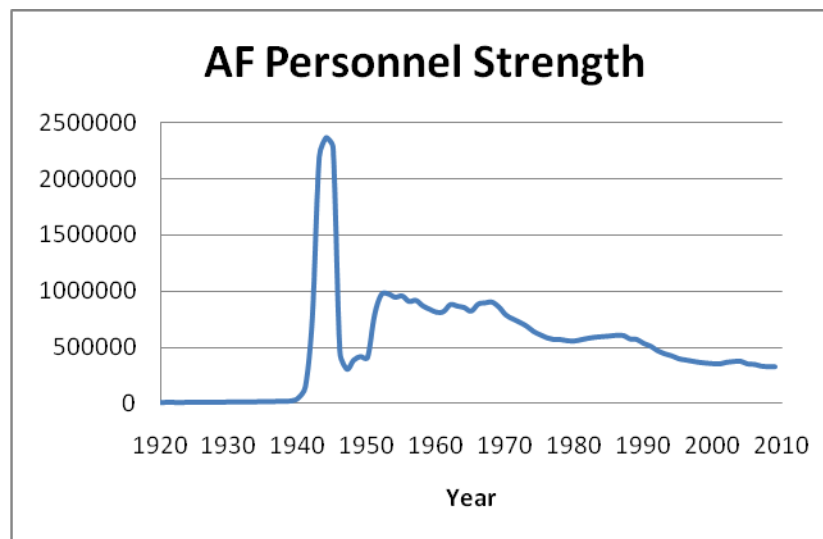

Figure 1: AF Personnel Strength
(Data from Statistical Abstract of the United States and Air Force Magazine)
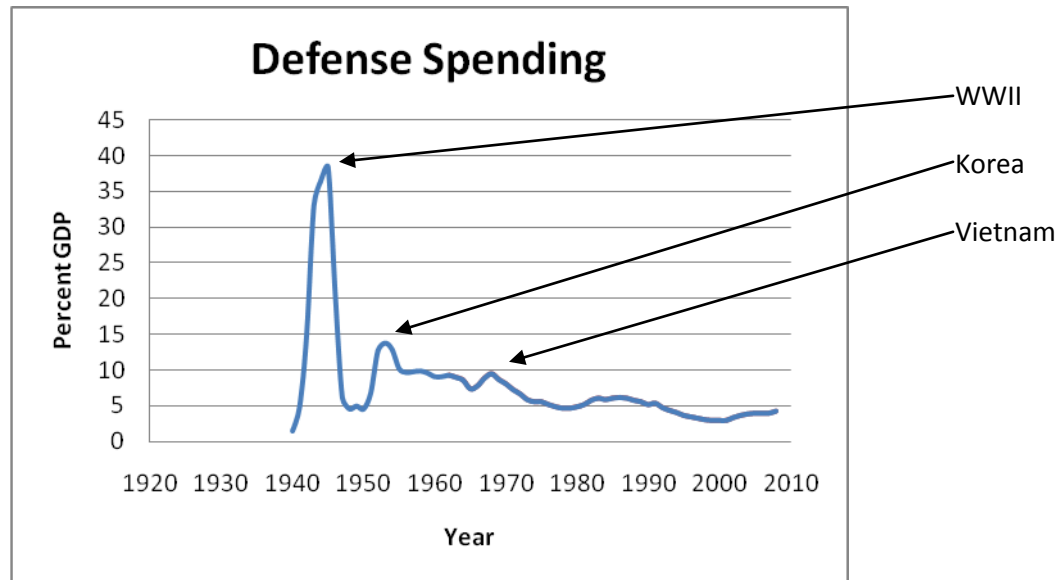
Figure 2: Defense Spending as Percent GDP
(Data from Statistical Abstract of the United States and Air Force Magazine)

During WWII, the defense budget grew to a high of 38.3 percent GNP and the personnel grew to

2.28M personnel while after the war the de-mobilization dropped to 6.2% GNP and 305K

personnel. Once again, during the Korean and Vietnam conflicts the budget grew to 13.8 and 9.5

percent respectively while the personnel grew to 977K and 904K personnel respectively.[2,3] The

last period of increases for budget and personnel was during the 1980's during the period of the

Ronald Regan presidency. After the Cold War, the FY 1991 authorization bill mandated

personnel cuts from 532K to 510K by the end of FY 1991 and to 415K personnel by 1995.[4]

Since 1987, there has been a steady decline in the defense spending and personnel strength to a

low of 3.0 percent GNP in year 2000 and to 327K in 2008.[5,6] During this last period, the U.S.

has been at war with Iraq and in Afghanistan, however unlike the previous conflicts there has not

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[2] United States Dept. of Commerce, *Statistical Abstract of the United States* (Washington, D.C.: U.S. Dept of Commerce, 1967), 252.
[3] "2009 USAF Almanac," *Air Force Magazine*, May 2009, 35, 40, 42.
[4] Bruce D. Callander, "Going: A Fifth of the Force," *Air Force Magazine,* February 1991, 37.
[5] United States Dept. of Commerce, 252.
[6] "2009 USAF Almanac," 35, 40, 42.

been an associated mobilization/de-mobilization, dramatically constraining the systems driving them to find ways to increase their efficiency to operate within their current monetary and personnel budgets.

Changing Organizational Demands During Periods of Conflict

The tactical aircraft maintenance organization has evolved with the rise and fall of defense spending and manpower strength. Resource availability enabled the decentralization of early years prior to WWII, technological changes complicated centralization post WWII, as military conflict requirements drove the need for organizational change. Furthermore, considering the direct correlation of training to maintenance expertise, the quality of maintenance training as a leading indicator predicted the future quality of aircraft repair and capability.

During the early years of aviation, the aircraft maintenance field was being formed with highly decentralized operations. Initial flight operations were conducted on a day-to-day basis, with no established written procedures. With the entry into WWI, the demand for aviation increased. The decentralized organization concept was used with each field level unit self-contained to maximize aircraft availability. Post WWI, in 1920 the aviation budget was cut from $55M requested to $25M, the Air Service was virtually demobilized, and the technical training schools were closed.[7] In addition, with the increased development of the commercial aviation

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[7] James N. Townsend, *A History of Aircraft Maintenance in the Army Air Force and United States Air Force,* (Air University, Air Command and Staff College Research Paper, May 1978), 16.

industry, in the 1930's 75% of those leaving the service were trained mechanics.[8] The

organization remained decentralized throughout the Interwar Period.

Aircraft maintenance significantly transformed during 1940's due to improvements in

technology and WWII requirements. The "crew chief" could no longer be expected to

understand and repair all the aircraft systems as they became more complex, causing the

development of the specialists. With entry into WWII, the Air Corps significantly expanded with

mobilization and decentralization. As the training demand became critical, technical courses

were shortened from six months to as little as 36 days to return mechanics to the field quicker.[9]

The organization did not centralize immediately after the WWII demobilization due to the

limited requirements; however training was dramatically cut degrading the maintenance

technician expertise.

Post WWII demobilization occurred where again the majority of the experience left the

service. At this time aircraft technology developed to the jet aircraft age, demanding even further

specialization. The combination of the demobilization and technology surge degraded

maintenance expertise and performance directly reducing aircraft availability. To address this

decline, in 1949 General Lemay centralized the maintenance organization to produce the

maximum aircraft available.[10] During this period, the heavy operational demand of the Berlin

Airlift relied heavily on the centralized maintenance concept due to the needed 24 hour

operations. The limited manning available to support this demand after the demobilization

would not support a decentralized concept as the same maintenance team would now be required

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[8] Capt Barbara L. Harris, *Challenges to United States Tactical Air Force Aircraft Maintenance Personnel: Past, Present and Future* (Air University; Air Force Institute of Technology Thesis, September 1991), 43.
[9] Ibid., 59.
[10] Townsend, 30.

to work more than 12 hrs per any given day.[11] During this period, the operational requirements combined with the constrained resources drove the organizational centralization.

During the 1950's, the nation entered the Korean conflict and the USAF again mobilized to meet the demands. The centralized organization of aircraft maintenance did not meet mission demands, as mission capable rates and aircraft condition dropped. During this period there was a lack of standardization; each major command developed and experimented with their separate structures in an attempt to meet their mission demands.[12] In addition, due to the continued complexity of aircraft such as the F-86, considerable improvement and development was required to compartmentalize the specialists and improve their training.[13]

During the Vietnam conflict, Tactical Air Command (TAC) decentralized their maintenance organization independent of other major commands, assigning components of maintenance under their associated flying squadrons. Their concept emphasis was to meet mobility requirements, develop self-contained tactical units under a single commander, focusing on the operational mission. With the mobilization for the Vietnam conflict, training had to be again shortened to meet the demand of the war. The mission needs negatively affected maintenance training, degrading the quality of maintenance repairs. The shortened training again led to limited experienced technicians to work on aircraft.[14] Similar to the previous world wars, the Korean and Vietnam conflict's operational requirements during periods of sufficient resources drove the organization to decentralize to meet the mission.

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[11] Lt Col Thomas E. Reiter, U*SAF Aircraft Maintenance Organizational Structure: Where We've Been, Where We Are, What's The Future* (Air University, Air War College, Research Report, April 1988), 7.
[12] Ibid., 8.
[13] Townsend, 35.
[14] Harris, 132.

Post Vietnam conflict, the USAF and TAC once again faced manning and budget challenges returning the organization to the centralized concept. The post conflict emphasis was to reduce duplication, with an emphasis of economy of effort.[15] In March 1972, an article published by HQ TAC specifically noted "…the TAC system and varying maintenance management systems of the other major commands have created some training problems…." and that "…standardization can become cost effective."[16]

Post Vietnam, the maintenance community continued to reorganize. TAC was again not satisfied with the centralized maintenance concept, as it did not support their deployment concept. TAC developed the Production Oriented Maintenance Organization, essentially capitalizing upon the Israeli Air Force concept of cross training specialists to accomplish crew chief tasks, assigning specialists to a new flightline oriented maintenance squadron. The level and number of skilled technicians directly contributed to the TAC's ability to meet their mission. In 1973, the TAC had a ratio of skilled to unskilled enlisted personnel of 1.76 when in 1978 the level dropped to 1.04.[17] During this period, the HQ USAF Director of Maintenance Engineering and Supply stated:

> Given the constraints in people and dollars we are faced with, there is a limit to how much running faster, jumping higher and sweating more we can do without some major changes in the way we go about our business.[18]

During the early 1990's the Air Force cut 24K personnel to meet the FY 1991 authorization bill directly affecting training programs. The manpower cuts were described that, "…in the short run it exacerbates understaffing and decreases morale by requiring senior people

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[15] Townsend, 44.
[16] Capt William B. James, "New Look in Aircraft Maintenance Management," *TAC Attack*, March 1972.
[17] Polly Carpenter-Huffman, *Putting On-the-job Training Under new Management to Improve Its Effectiveness,* (Santa Monica, California: RAND Corporation, March 1979), 6.
[18] Reiter, 20.

to do things traditionally done by junior people."[19] Unfortunately, the senior people may do the work or the work would be simply out prioritized by other existing workloads. On 9 October 1998, the Air Force Audit Agency published a report on aircraft maintenance training stating, "Active duty aircraft maintenance personnel did not receive all training needed to adequately perform aircraft maintenance operations, and related internal controls were not totally effective." In response to the audit, AF/IL stated, "Maintenance supervisors are typically only reviewing personnel in training during annual training reviews. Upgraded personnel are usually overlooked."[20] It is clear that the lack of resources has degraded the effectiveness of the maintenance training. These limited resources once again drove the organization to centralize operations, while dramatically reducing the maintenance expertise through degraded maintenance training.

History demonstrates the dramatic negative effect of resource availability on the aircraft maintenance community. During conflict with sufficient resources, the organization decentralized to meet mission demands. During periods with constrained resources such as the interwar periods, the organization returned to a centralized structure. Maintenance training is routinely out-prioritized in centralized organizations, becoming reduced if not canceled. Limited training degrades maintenance personnel's ability to repair their systems, degrading the mission capability of our aircraft fleets. Today the organization remains centralized; however resources are extremely constrained while we are supporting combat operations. The strain on the community in this environment is clear, driving us to further centralize and consolidate where possible to eliminate any duplication and reduce costs.

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[19] John Ginovsky, "One certainty for 1990: a smaller Air Force," *Air Force Times,* January 1, 1990, 8.
[20] United States, Air Force Audit Agency, *Aircraft Maintenance Training Within Active Duty Units,* (Washington, D.C., Air Force Audit Agency, 1988), 3.

UPCOMING CHANGES WITH ECSS

ECSS has been developed to answer the need to transform the logistics processes in an environment of declining resources and manpower while maintaining current operations tempo. The need for change addresses outdated processes developed since the WWII period with a modern, commercial solution. The system focuses on data management, and having a single accurate data source. An implementation plan has been developed, and is currently underway.

With declining budgets and the need to upgrade aging fleets of aircraft, following the historical past the need to centralize operations once again becomes necessary. In 2003, the Office of the Secretary of Defense mandated the following transformational objectives:

- Optimize warfighter support
- Improve strategic mobility to meet operational requirements
- Implement customer wait time as a cascading metric
- Fully implement total asset visibility
- Reengineer applicable processes and systems to increase overall communication and operational situational awareness
- Achieve best-value logistics while meeting requirements at reduced operating costs[21]

In 2005, the Air Force launched ECSS to retire over 250 legacy systems with a single commercial off the shelf system. ECSS is designed to eliminate the multitude of stand-alone systems causing duplication of effort and inefficiency costing over $27.5B to maintain.[22] The system is to address supply asset visibility with a single solution reducing supply disruptions. Using current technology, real time data flow can improve scheduling and maintenance. This system is to merge the base and depot level logistics systems.[23] According to the ECSS Playbook,

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[21] *ECSS History*, April 3, 2009, https://www.ecss.wpafb.af.mil, (Accessed 19 August 2009).
[22] Ibid.,1.
[23] *Why ECSS*, April 3, 2009, https://www.ecss.wpafb.af.mil, (Accessed 19 August 2009).

Benefits include the establishment of a common set of logistics business processes, improved data quality, real-time information, and universal access to information.[24]

The core of the current legacy systems resides in information systems containing the logistic data used to supply and maintain our weapon systems. As an information management system, data accuracy/input becomes critical. An ECSS goal is to improve data quality; the proper data accuracy and transfer to the new ECSS becomes critical to success. Maj Gen Owen, HQ AFMC/A4 stated,

These data objects are required to be as accurate as possible; they are the foundational building blocks to other portions of ECSS. If the foundational data is not as accurate as possible, future business processes within ECSS may not function as desired.[25]

The data in the legacy systems will have to be prepared to be migrated to the ECSS. The data preparation will happen at locations across the AF, and will require teams of individuals to accomplish. As part of the USAF's contract with the contractor is that the USAF is obligated to provide functionally accurate data, which will have to be "cleansed" prior to induction to ECSS. With data cleansing, the existing data in the legacy systems will have to be reviewed with the level of effort dependent upon the accuracy of the existing legacy system.

The ECSS implementation plan is a four phase program with full implementation currently scheduled for 2015. Hanscom AFB is the pilot for Release 1, Hill AFB Release 2 and 3 and Maxwell AFB Release 4. Hanscom AFB will test Release 1 through 2010, and use the system in daily operations until 2011 at which point the other 600 locations will begin to use the

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[24] *The Playbook: Leading the ECSS Transformation*, November 2008, https://www.ecss.wpafb.af.mil, (Accessed 19 August 2009), 9.
[25] *The Enabler: The Official Newsletter of the Expeditionary Combat Support System*."Volume 3, Issue 3, June 2009, https://www.ecss.wpafb.af.mil, (Accessed 19 August 2009), 5.

system.[26] Release 1 is funded with FY09 spending just over $200M, with the total program

required funding estimated at $1.440B.[27] The implementation by release:

Rel #	Area	# Users	# Locations	Capability	Targeted Systems
1	Base Materiel & Equip Mgmt	40,000	600	Vehicle Mgmt, Equip Mgmt, Material Mgmt, Wireless Computing	OLVIMS, ILS, AFEMS, TAS SMAS, DoDAAC, SPIRES, TC Max, ECC, SRWP, MICAS
2	Global Materiel & Equip Mgmt	30,000	7	Global Supply, PLM, Eng Change Orders, Enterprise, Ammo Planning, Fin Mgmt	RMS, AMST, CIMS, CITOMS, CRMS, ETIMS, JCALS, JEDMICS, LOGMOD, SCS, SMAG, WSMIS
3	Depot Mx Repair and Overhaul	30,000	6	Depot Maintenance Planning, Scheduling, Enterprise Planning	DCAST, DMAPS, DMMS, EMIS, LDMS, MP&E, PDMSS, RMF, SORAP
4	Flightline/Ammunition Mgmt	150,000	200	Flightline Maintenance, Ammo Execution, Sortie Generation	IMDS, CAS, CAMS, REMIS, AFTOX, CCAR, WAPDS, AITS, AMCS, APTS, DRILS

Table 1: ECSS Release Areas Impact[28]

For the activation of a given location, the process is scheduled to be a 24 month process. The

process is a methodical, education/transition focused process to enable personnel to gradually

understand the pending changes to the system. The last three months of the activation transition

to the specific training and cut-over of the system.[29] For training, there are currently 11 web

based training courses developed for the ECSS development team offered through the Air Force

Institute of Technology online.[30] For systems users, the training will be a combination of

classroom and computer based training. This training will be delivered based upon the activation

schedule for the given location.[31]

[26] Capt Geoff Buteau, *Town-Hall Meeting Covers Initial Reaction to ECSS Kickoff,*
http://www.afmc.af.mil/news/story.asp?id=123171728.
[27] Lt Col Stefan Dosedel, Briefing: *Expeditionary Combat Support System (ECSS) IRB*, Slide 5.
[28] Ibid., Slides 16-19.
[29] *The Playbook: Leading the ECSS Transformation,* 25-33.
[30] *ECSS Education*, April 6, 2009, https://www.ecss.wpafb.af.mil, (Accessed 19 August 2009).
[31] *ECSS Frequently Asked Questions,*" April 6, 2009, https://www.ecss.wpafb.af.mil, (Accessed 19 August 2009).

The ECSS change will change the entire AF and the way it does business; the largest change since the inception of the USAF. As it eliminates over 240 of outdated and redundant systems, it will directly affect hundreds of thousands of AF personnel and their personal contribution to USAF operations. The change will directly affect personnel at both the wing and depot level, and will begin with the 24 month transition process. This process begins with the selection of the Change Agent Coordinator at each location who will facilitate the transition and serve as the locations liaison with the ECSS program. Once the transformation has begun, each organization will also select their Change Agent Coordinators to work with the installation coordinator.[32] In Table 1, the ECSS impact to the "user" is broken down by release. The "user" is defined as any individual who has access and/or uses any of the targeted legacy database systems. An individual who uses the systems can expect their 24 month introduction and indoctrination to the new system prior to activation. Each individual can expect to receive training both in the classroom environment and through computer based training.

Change management is a well documented subject, with corporations created for the purpose of managing other's change. There are three aspects of change management to mention relative to the subject of the change to ECSS: first, the need for change; second the level of change relative to risk; and finally the importance of leadership with the change will be addressed.

The need for change is a common discussion in the military; as previously discussed the history of aircraft maintenance change has been constant. From the historical perspective, it becomes evident that during times of declining resources of both personnel and budgetary the organization centralizes to accommodate their losses. During our current times of budget cuts

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[32] *The Playbook: Leading the ECSS Transformation,* 23.

and national economic trouble, the only viable choice is to consolidate and centralize. The

challenge of centralization is to maintain a high quality while still meeting operational needs.

With declining resources, the responsibility falls upon the maintenance leadership to maintain

the quality standards while providing fact based assessments on operational capability. The

centralization of systems will reduce the risk with the limited resources while trying to increase

the probability of success. However, the level of risk with the magnitude of the ECSS

transformation is high and must be managed to ensure success with this $1.440B change.

The importance of leadership is significant with the implementation of ECSS. With the

implementation, once the transformation is complete all of the redundant systems must be

discontinued and no longer used. Without discontinuing the systems, the AF will not realize the

needed savings and will further complicate a resource constrained organization. Leadership is

also critical to the success of ECSS, as in any aspect of any organization. As can be seen in the

history of the aircraft maintenance field, leadership led the multitude of changes based upon the

constraints of each period. The ECSS program implementation will be significant with high risk

requiring consistent leadership at all levels understanding and facilitating the changes. Due to

the program magnitude, the implementation will occur over several years requiring consistent

leadership support over the entire period. A change in leadership direction or support mid

implementation can have devastating effects as the legacy systems have lost their support

funding and the new system implementation may become incomplete.

LESSONS LEARNED

There are a multitude of considerations ECSS implementation leaders must consider to

help guarantee success. An historical understanding will provide an initial perspective;

understanding the cause and effect of reorganization will help minimize recurrence of past mistakes. As previously discussed the aircraft maintenance community has continually reorganized since its inception. This ECSS program change is immense. This is significantly more complex and involved than a functional reorganization due to its extensive level of impact; affecting hundreds of thousands of personnel vs. a leadership alignment or reorganization.

As an information system, the ECSS program must address the lack of success with the current logistics systems and their shortfalls, and the strategic implication of centralizing to the level predicted. A critical aspect of ECSS is data management and data accuracy. The importance of data management has been directly linked to the success of the system; unfortunately historically data management has been an area of constant attention and improvement for the aircraft maintenance community. The aircraft maintenance community relies on its Maintenance Data Collection (MDC) system. In 1974 it was noted that the MDC system which provides systems performance, equipment problem, failure data, etc had "yet to attain the degree of success originally intended."[33] In addition, "there was a basic distrust in the system" where the maintenance technicians thought the system was "complex and time consuming," causing inaccurate data and invalid reports. Overall, maintenance technicians thought the use of the system was "marginal."[34] Four years later,

> History tells us that without the shaping of the information system to the needs of the users, significant problems and inefficiencies can result. The people who collect data must understand how it benefits the functions they perform. If the maintenance information was tailored to specific users and results of its use clearly demonstrated, emotional argument with the documentation requirement could be reduced.[35]

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[33] GS-12 Alex J. Zappavigna, *The Maintenance Data Collection System,* (Air University, Air Command and Staff College, Research Paper, May 1974), 31.
[34] Ibid., 31.
[35] Richard V. Badalamente, PhD and Thomas D. Clark, Jr., Maj, *Spinning Our [Information] Wheels: A Look at the Maintenance Data Collection System,* (Air University, Air Force Institute of Technology, Research Paper, February 1978), 19.

In 1991, the inaccurate data in the MDC system was evaluated and a survey was given as part of the research. The survey found 35% were due to data entry difficulty, 27% was due to insufficient training, and 24% was due to difficulty in using the program.[36] The first recommendation of the analysis was to improve training due to a perceived lack thereof.[37] In 1994, MDC management was again reviewed, and it concluded,

> First, the Air Force must decide if a maintenance data collection system is still necessary, or whether there are alternatives that could provide the same data. If the conclusion is that the MDC system is still necessary, the improvements must be made to each of the five elements of the process, beginning with the way technicians are trained on MDC.[38]

The additional training requirements to include recurring training must consider the current environment while understanding past implications of budget and manning levels. As previously discussed, historically individual training programs have been significantly reduced through the constant reorganization. In 1979, the importance of on-the-job training with the effect of reorganization was highlighted,

> …the increased technological sophistication of military equipment and systems, which places greater demands on maintenance personnel. Even systems that have been designed to minimize demands for maintenance in the field often require special skills that are inadequately taught in an introductory course.[39]

In November 1982, a study was conducted on the DoD training and training technology. The study found "There is a major disconnect between the activities of the 'hardware people' and the 'people people…'" describing a disconnect between the system designers and the users. [40] This In addition, the study noted,

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[36] Capt Jon R. Determan, *Inaccurate Data Entry Into the Air Force Maintenance Data Collection System,* (Air University, Air Force Institute of Technology, Thesis, September 1991), 70.
[37] Ibid., 71.
[38] Lt Col Robert H. McMahon, *Quality, Measurement, and Air Force Maintenance Data Collection: What is Wrong With the Process,* (Air University, Air War College, Research Report, April 1994), 27.
[39] Carpenter-Huffman, 2.
[40] Raymond E. Reilly, and Billy E. Rutherford, *Support of Defense Science Board Summer Study on Training and Training Technology,* (Alexandria, Virginia: Allen Corporation of America, Defense Science Board and DARPA project, November 1982), 5.

There is a disconnect between the skill performance requirements for operation and maintenance of new weapons systems and the aptitude of the available or projected manpower to meet those requirements. Training provides whatever link there is, but that link is approaching its limit.[41]

In October 1998, an audit by the Air Force Audit Agency on aircraft maintenance training concluded, "Active duty aircraft maintenance personnel did not receive all training needed to adequately perform aircraft maintenance operations, and related internal controls were not totally effective."[42] When considering the type of training, the effect of technology can be both a strength and weakness. Training effectiveness must be balanced against the emphasis to migrate towards web based training, with web based training being an impoverished method compared to the traditional classroom environment. The Office of the Under Secretary of Defense for Research and Engineering commissioned a study on the cost-effectiveness of computer-based training. The study concluded,

There is no evidence that one method of instruction is most cost-effective for all types of military training. The most cost-effective method for a particular situation will depend upon such factors as type of course material, location of instruction, numbers of students, and life-span of the training.[43]

With the magnitude of the change with ECSS, adequate and effective training must be planned and provided, both initial and recurring, considering reorganization through the history of the organization.

FUTURE SUCCESS OF ECSS

The decision on whether or not to incorporate ECSS has been made, as the test bases have begun their evaluations. The future and degree of success of the ECSS program is still yet

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[41] Ibid., 8.
[42] United States, Air Force Audit Agency, *Aircraft Maintenance Training Within Active Duty Units,* (Washington, D.C., Air Force Audit Agency, 1988), synopsis.
[43] Jesse Orlansky and Joseph String, *Cost-Effectiveness of Computer-based Instruction in Military Training,* (Arlington, Virginia: Institute for Defense Analyses Science and Technology Division, April 1979), 78.

to be determined, particularly in the aircraft maintenance arena. To improve the probability of

success with ECSS, the USAF and DoD leadership should consider the "lessons learned" at the

tactical aircraft maintenance level as it has undergone nearly continuous change from the

inception of the Air Force. From the historical perspective, it is clear that with declining

resources the organization must consolidate while also taking the opportunity to eliminate

redundant systems or process waste. As highlighted in this paper, three focus areas would be

leadership, the challenge of data integrity, and training development and implementation.

Leadership is critical under any circumstance. Significant organizational change has not

succeeded without complete support of the leadership structure; likewise a lack of leadership

support will greatly impede or undermine the change. The ECSS playbook dedicates the majority

of its space to organizational change and the importance of leadership. It discusses

transformational leadership stating, "To result in effective change, organizational change

management efforts require committed leadership…."[44] General Lemay and General Creech are

examples of successful leaders considering their changing environment, and their ability to adapt

to constrained resources maximizing their maintenance effectiveness.[45] The level of success of

the ECSS will depend upon the level of leadership support for the change. The leadership at all

levels must be educated on the change; understanding and accepting its nature so they can fully

support the transformation. In addition, the leadership structure must be equipped and supported

to make the change at their respective levels. Artificial or unrealistic timelines will cause

shortcuts or lead to incorporation issues. The conflict between operational requirements and

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[44] *The Playbook: Leading the ECSS Transformation,* 15.
[45] Maj Charles D. Johnson, *USAF Aircraft Maintenance Management, is There a Better Way?,* (Air University, Air Command and Staff College, Research Report, April 2000), 23.
General Lemay and General Creech were successful due to their direct application of leadership. As written, General Lemay drove the first centralization of aircraft maintenance as a result of the Berlin Airlift. General Lemay is well known for his impeccable compliance focus and exceptional standards. General Creech's mission driven leadership style dramatically increased TAC sortie production. Under General Creech's leadership mission capable rates increased from 56% to 86%, and TAC was meeting their sortie goals.

managing this change must be addressed. Simply "piling on" more work and indicating it to be a

"leadership problem" will only lead to trouble. This level of change will take time, and time

must be given. As previously stated, the AF will be operating in a constrained environment for

both financial and personnel support, the resources must be freed to address the workload of the

change.

As previously stated, the quality of data is a significant aspect of the ECSS, however

historically aircraft maintenance data quality is significantly lacking. As soon as human factors

are applied to the system, the potential for errors exists. ECSS must address the environmentally

challenging, operations driven aircraft maintenance environment. Simply creating another

maintenance data collection system would result in the similar successes of the current systems.

Finally, system training must be considered. Simply stated, time must be provided for

effective training. It has been shown historically training routinely becomes second priority over

operational needs. Due to the level of the ECSS change, operational requirements will need to

be lowered during implementation to allow for all users to receive the correct level of training

and to become familiar with the new systems. Similar to bringing a weapon system on-line, this

change should receive the same due consideration.

CONCLUSION

In October 1958, it was concluded "The technology of electronic data processing

equipment is now so advanced that is entirely feasible to incorporate data processing centers into

the weapon system support concept."[46] Over 50 years later, the AF will again centralize with the

ECSS program to reduce operating budgets while eliminating duplication. The ECSS impact to

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[46] Leon Gainen, *The Next Step in Air Force Centralization of Inventory Recordkeeping and Supply Data Processing*, (Santa Monica, California, U.S. Air Force Project Rand Research Memorandum, 16 October 1958), 53.

our AF is huge; it will be the largest change to date. This will only work with priority resources, engaged leadership, and effective training applied for the duration. This centralization is needed to maximize the limited resources with a shrinking budget while we a historically continue to fight our wars. Historically, during periods of conflict the USAF mobilized with sufficient resources, followed by organizational decentralization to support the mission.

History has proven during periods of constrained resources training programs have been dramatically affected. Yet, the reality is that effective training saves resources through quality and efficient maintenance. The system must address user inputs. The history with the maintenance data system shows conflict between the system design and the user leads to suspect data and an ineffective system. With a data consolidation, data integrity will be paramount; there will be no parallel systems of redundancy. The success of this entire program hinges upon adequately resolving this issue.

At the end, focus on the warfighter is essential; their success depends upon support. We have entered an a historic period: the first time in history we have been supporting major combat operations with constrained resources. Logistic sustainment system failure will drive the outcome of the combat operations. The transition to the ECSS system directly impacts these critical logistics systems, and perturbations in support can have devastating effects on the ability to meet the mission for extended periods of time.

ECSS affects the individual warfighter. Maintenance technicians in the combat area of operations must be effectively trained on the new system, and must operate efficiently. The system must be clear and easy to use, so the technician can request the proper support and system will meet the technician's needs.

The foreseeable future for ECSS will be full of risk with potential for lasting negative consequences. A shortage of funding will cause further implementation delays; while the legacy systems are no longer supported. The risk of system centralization combined with the current globalization of technology and cyber type threats must be addressed. The system conversion is achievable; only with consistent leadership focus and priority. Any support gaps will degrade supportability and weapon system sustainment, and ultimately the technician's ability to complete their mission.

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